Please add claims 3-15 as follows:

--~~3~~ 1. A method for self-routing a packet through a $b2^n \times b2^n$ switching network comprising

configuring the switching network with (a) 2^n output groups, each of the output groups having a distinct binary output group address in the form of $b_1b_2 \ldots b_n$ with b indistinguishable output ports, and (b) k super-stages of 2b-to-b multicast concentrators wherein each of the multicast concentrators is a $2b \times 2b$ partial sorting network of interconnected bicast cells and b of its 2b output ports are grouped into a 0-output group with the remaining b output ports being grouped into a 1-output group, the network being characterized by the guide $\gamma(1), \gamma(2), \ldots, \gamma(k)$, where γ is a mapping from the set $\{1, 2, \ldots, k\}$ to the set $\{1, 2, \ldots, n\}$, and wherein the packet is either a real data packet destined for a rectangular set of output group addresses represented by a quaternary sequence $Q_1, Q_2, \ldots, Q_n$, where each Q_j is a quaternary symbol in any of the three values representing '0-bound', '1-bound' or 'bicast', or an idle packet having no pre-determined destination,

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generating a routing tag $Q_{\gamma(1)}Q_{\gamma(2)} \ldots Q_{\gamma(k)}$ for the packet with reference to the guide of the network and the destination output group addresses of the packet, wherein each $Q_{\gamma(j)}$, $1 \leq j \leq k$, has a value representing 'idle' if the packet is an idle packet or has one of the three values representing '0-bound', '1-bound' or 'bicast' if the packet is a real data packet, and

routing the packet through the network by using $Q_{\gamma(j)}$ in the routing tag of the packet in the j-th super-stage multicast concentrator, $1 \leq j \leq k$, to select an output group or both output groups from the j-th super-stage multicast concentrator to emit the packet.

4. A method for self-routing a packet through a $b2^n \times b2^n$ switching network, the network comprising 2^n output groups, each of the output groups having a distinct binary output group address in the form of $b_1 b_2 \ldots b_n$ with b indistinguishable output ports, and k super-stages of 2b-to-b multicast concentrators wherein each of the multicast concentrators is a $2b \times 2b$ partial sorting network of interconnected bicast cells, and b of its 2b output ports are grouped into a 0-output group while the remaining b output ports are grouped into a 1-output group, the network being characterized by the guide $\gamma(1)$, $\gamma(2), \ldots, \gamma(k)$, where γ is a mapping from the set $\{1, 2, \ldots, k\}$ to the set $\{1, 2, \ldots, n\}$, and the packet being either a real data packet destined for a rectangular set of output group addresses represented by a quaternary sequence $Q_1, Q_2, \ldots, Q_n$, where each Q_j is a quaternary symbol in any of the three values representing '0-bound', '1-bound' or 'bicast', or being an idle packet having no pre-determined destination, the method comprising

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generating a routing tag $Q_{\gamma(1)} Q_{\gamma(2)} \ldots Q_{\gamma(k)}$ for the packet with reference to the guide of the network and the destination output group addresses of the packet, wherein each $Q_{\gamma(j)}$, $1 \leq j \leq k$, has a value representing 'idle' if the packet is an idle packet or has one of the three values representing '0-bound', '1-bound' or 'bicast' if the packet is a real data packet, and

routing the packet through the network by using $Q_{\gamma(j)}$ in the routing tag of the packet in the j-th super-stage multicast concentrator, $1 \leq j \leq k$, to select an output group or both output groups from the j-th super-stage multicast concentrator to emit the packet.

7. A method for self-routing a plurality of real data packets through a $b2^n \times b2^n$ switching network, the switching network being characterized by the guide $\gamma(1), \gamma(2), \ldots, \gamma(k)$ where γ is a mapping from the set $\{1, 2, \ldots, k\}$ to the set $\{1, 2, \ldots, n\}$, and having (a) $b2^n$ external input ports, (b) 2^n output groups, each of the output groups having a distinct binary output group address in the form of $b_1 b_2 \ldots b_n$ with b indistinguishable output ports, and (c) k super-stages of 2b-to-b multicast concentrators wherein each of the multicast concentrators is a $2b \times 2b$ partial sorting network of interconnected bicast cells where each of the bicast cells is a sorting cell associated with the partial order "'0-bound' $\prec$ 'idle' $\prec$ '1-bound' and '0-bound' $\prec$ 'bicast' $\prec$ '1-bound'", b of the 2b output ports of each of the multicast concentrators are grouped into a 0-output group while the remaining b output ports are grouped into a 1-output group, and augmenting circuitry is installed at the output end of each of the multicast concentrators where the augmenting circuitry is composed of 2b parallel 1×1 switching elements, one at each of the output ports of the multicast concentrator, and each of the real data packets arriving at a distinct external input port determining an active input port and destined for a rectangular set of output group addresses represented by a quaternary sequence $Q_1, Q_2, \ldots, Q_n$, where each Q_j is a quaternary symbol in any one of the three values representing '0-bound', '1-bound' or 'bicast', the method comprising

A5 Cont.

generating an idle packet as a stream of '0' bits at each of the non-active external input ports,

generating a routing tag $Q_{\gamma(1)} Q_{\gamma(2)} \ldots Q_{\gamma(k)}$ for the packet with reference to the guide of the network and the destination output group addresses of the packet, wherein each $Q_{\gamma(j)}$, $1 \leq j \leq k$, has a value representing 'idle' if the packet is an idle packet or

has one of the three values representing '0-bound', '1-bound' or 'bicast' if the packet is a real data packet,

routing the real data packets and the idle packets through the network by sorting the packets by the 2b-to-b multicast concentrators of the network, wherein the sorting at each of the multicast concentrators includes the sorting at each of the sorting cells of the multicast concentrator where the sorting is with respect to the associated partial order and is based upon the leading quaternary symbol of the routing tag of each of the two packets arrived at the cell, wherein the leading quaternary symbol of the routing tag of each of the packets at each of the sorting cells of each of the j-th super-stage multicast concentrators, $1 \leq j \leq k$, is always $Q_{\gamma(j)}$, and

AS Cont.

processing the routing tag of each of the packets by the augmenting circuitry at the output end of the multicast concentrator before the said each of the packets exiting from the j-th super-stage multicast concentrator by removing the leading quaternary symbol from the routing tag or rotating the leading quaternary symbol to the end of the routing tag to make the leading quaternary symbol of the routing tag of each of the packets at each of the j-th super-stage multicast concentrators, $1 \leq j \leq k$, always be $Q_{\gamma(j)}$.

6. The method as recited in claim 5 wherein the real data packets are classified into 2^r priority classes, $r \geq 1$, where each of the priority classes is coded in an r-bit string $p_1 \ldots p_r$, the generating of routing tag for the real data packet includes generating $Q_{\gamma(1)} p_1 \ldots p_r Q_{\gamma(2)} \ldots Q_{\gamma(k)}$ as the routing tag, the sorting at each of the sorting cells of the multicast concentrators based upon the leading quaternary symbol of each of the routing tags includes using the ensuing priority code $p_1 \ldots p_r$ as the tiebreaker when the two

packets arrived at the same sorting cell are both 0-bound or both 1-bound, and the processing of the routing tag includes removing the leading quaternary symbol from the routing tag or rotating the leading quaternary symbol to the end of the routing tag, and rotating the r-bit priority code $p_1 \ldots p_r$ to the position behind the next quaternary symbol originally following the priority code in the routing tag such that the routing tag of each of the packets at each of the j-th super-stage concentrators, $1 \leq j \leq k$, always begins with $Q_{\gamma(j)} p_1 \ldots p_r$.

7. The method as recited in claim 6 wherein the routing of packets includes blocking the misrouted packets at the output end of each of the 2b-to-b multicast concentrators when the two packets arrived at the same sorting cell are both 0-bound or both 1-bound and have the same priority, wherein an misrouted packet is either a 0-bound packet being routed to the 1-output group of the multicast concentrator or a 1-bound packet being routed to the 0-output group of the multicast concentrator.

A5 cont.

8. The method as recited in claim 7 wherein the blocking of the misrouted packets includes turning the misrouted packet into a string of '0' bits as an idle packet.

~~9~~. A system for self-routing a packet comprising

a $b2^n \times b2^n$ switching network, the network comprising 2^n output groups, each of the output groups having a distinct binary output group address in the form of $b_1 b_2 \ldots b_n$ with b indistinguishable output ports, and k super-stages of 2b-to-b multicast concentrators wherein each of the multicast concentrators is a $2b \times 2b$ partial sorting

network of interconnected bicast cells, and b of its 2b output ports are grouped into a 0-output group while the remaining b output ports are grouped into a 1-output group, the network being characterized by the guide $\gamma(1), \gamma(2), \ldots, \gamma(k)$, where γ is a mapping from the set $\{1, 2, \ldots, k\}$ to the set $\{1, 2, \ldots, n\}$, and the packet being either a real data packet destined for a rectangular set of output group addresses represented by a quaternary sequence $Q_1, Q_2, \ldots, Q_n$, where each Q_j is a quaternary symbol in any of the three values representing '0-bound', '1-bound' or 'bicast', or being an idle packet having no pre-determined destination,

routing tag circuitry for generating a routing tag $Q_{\gamma(1)}Q_{\gamma(2)}\ldots Q_{\gamma(k)}$ for the packet with reference to the guide of the network and the destination output group addresses of the packet, wherein each $Q_{\gamma(j)}$, $1 \le j \le k$, has a value representing 'idle' if the packet is an idle packet or has one of the three values representing '0-bound', '1-bound' or 'bicast' if the packet is a real data packet, and

AS Cst.

routing control circuitry for routing the packet through the network by using $Q_{\gamma(j)}$ in the routing tag of the packet in the j-th super-stage multicast concentrator, $1 \le j \le k$, to select an output group or both output groups from the j-th super-stage multicast concentrator to emit the packet.

10. A switch for self-routing a plurality of real data packets comprising

$b2^n \times b2^n$ switching fabric having a plurality of 2b-to-b multicast concentrators interconnected into a k-stage bit-permuting network which is characterized by the guide $\gamma(1), \gamma(2), \ldots, \gamma(k)$ where γ is a mapping from the set $\{1, 2, \ldots, k\}$ to the set $\{1, 2, \ldots, n\}$, and having (a) $b2^n$ external input ports, (b) 2^n output groups, each of the

output groups having a distinct binary output group address in the form of $b_1b_2 \ldots b_n$ with b indistinguishable output ports, and (c) k super-stages of 2b-to-b multicast concentrators wherein each of the multicast concentrators is a 2b×2b partial sorting network of interconnected bicast cells where each of the bicast cells is a sorting cell associated with the partial order "'0-bound' $\prec$ 'idle' $\prec$ '1-bound' and '0-bound' $\prec$ 'bicast' $\prec$ '1-bound'", b of the 2b output ports of each of the multicast concentrators are grouped into a 0-output group while the remaining b output ports are grouped into a 1-output group, and augmenting circuitry is installed at the output end of each of the multicast concentrators where the augmenting circuitry is composed of 2b parallel 1×1 switching elements, one at each of the output ports of the multicast concentrator, and wherein each of the real data packets arrives at a distinct external input port and is destined for a rectangular set of output group addresses represented by a quaternary sequence $Q_1, Q_2, \ldots, Q_n$, where each Q_j is a quaternary symbol in any one of the three values representing '0-bound', '1-bound' or 'bicast',

A8 cont

idle-packet-generating circuitry, coupled to the external input ports, for generating an idle packet as a stream of '0' bits at each of the external input ports of the switching fabric if no real data packet arrived at that external input port,

routing tag circuitry, coupled to the external input ports, for generating a routing tag $Q_{\gamma(1)}Q_{\gamma(2)} \ldots Q_{\gamma(k)}$ for the packet with reference to the guide of the network and the destination output group addresses of the packet, wherein each $Q_{\gamma(j)}$, $1 \leq j \leq k$, has a value representing 'idle' if the packet is an idle packet or has one of the three values representing '0-bound', '1-bound' or 'bicast' if the packet is a real data packet,

routing control circuitry, coupled to the sorting cells of the concentrators, for routing the real data packets and the idle packets through the network by sorting the packets by the 2b-to-b multicast concentrators of the network, wherein the sorting at each of the multicast concentrators includes the sorting at each of the sorting cells of the multicast concentrator where the sorting is with respect to the associated partial order and is based upon the leading quaternary symbol of the routing tag of each of the two packets arrived at the cell, wherein the leading quaternary symbol of the routing tag of each of the packets at each of the sorting cells of each of the j-th super-stage multicast concentrators, $1 \leq j \leq k$, is always $Q_{\gamma(j)}$, and

augmenting circuitry, coupled to the output end of each of the multicast concentrators, for processing the routing tag of each of the packets before the said each of the packets exiting from the j-th super-stage multicast concentrator by removing the leading quaternary symbol from the routing tag or rotating the leading quaternary symbol to the end of the routing tag to make the leading quaternary symbol of the routing tag of each of the packets at each of the j-th super-stage multicast concentrators, $1 \leq j \leq k$, always be $Q_{\gamma(j)}$.

A6 Cont

11. The switch as recited in claim 10 wherein the real data packets are classified into 2^r priority classes, $r \geq 1$, where each of the priority classes is coded in an r-bit string $p_1 \ldots p_r$, the generating of routing tag for the real data packet is the generating of $Q_{\gamma(1)} p_1 \ldots p_r Q_{\gamma(2)} \ldots Q_{\gamma(k)}$ as the routing tag, each of the sorting cells of the multicast concentrators sorts the two arriving packets based upon the two leading quaternary symbols of the routing tags of the two packets using the ensuing priority code $p_1 \ldots p_r$ as

the tiebreaker when the two packets arrived at the same sorting cell are both 0-bound or both 1-bound, and the augmenting circuitry at the output end of the multicast concentrator process the routing tag of each of the packets before the said each of the packets exiting from the j-th super-stage multicast concentrator by removing the leading quaternary symbol from the routing tag or rotating the leading quaternary symbol to the end of the routing tag, and rotating the r-bit priority code $p_1 \ldots p_r$ to the position behind the next quaternary symbol originally following the priority code in the routing tag such that the routing tag of each of the packets at each of the j-th super-stage concentrators, $1 \leq j \leq k$, always begins with $Q_{\gamma(j)} p_1 \ldots p_r$.

12. The switch as recited in claim 10 wherein the switch includes delay elements in the 2b-to-b multicast concentrator for maintaining the synchronization of the packets across the stage.

13. The switch as recited in claim 10 wherein the augmenting circuitry at the output end of each of the 2b-to-b multicast concentrators blocks the misrouted packets at the output end of each of the 2b-to-b multicast concentrators when the two packets arrived at the same sorting cell are both 0-bound or both 1-bound and have the same priority, wherein an misrouted packet is either a 0-bound packet being routed to the 1-output group of the multicast concentrator or a 1-bound packet being routed to the 0-output group of the multicast concentrator.

14. The switch as recited in claim 13 wherein the blocking of the misrouted packets by the augmenting circuitry at the output end of each of the 2b-to-b multicast concentrators includes turning the misrouted packet into a string of '0' bits as an idle packet.

A5 Concl.

15. The switch as recited in claim 10 wherein the switch includes annihilators of misrouted packets at the output end of each of the 2b-to-b multicast concentrators.--.